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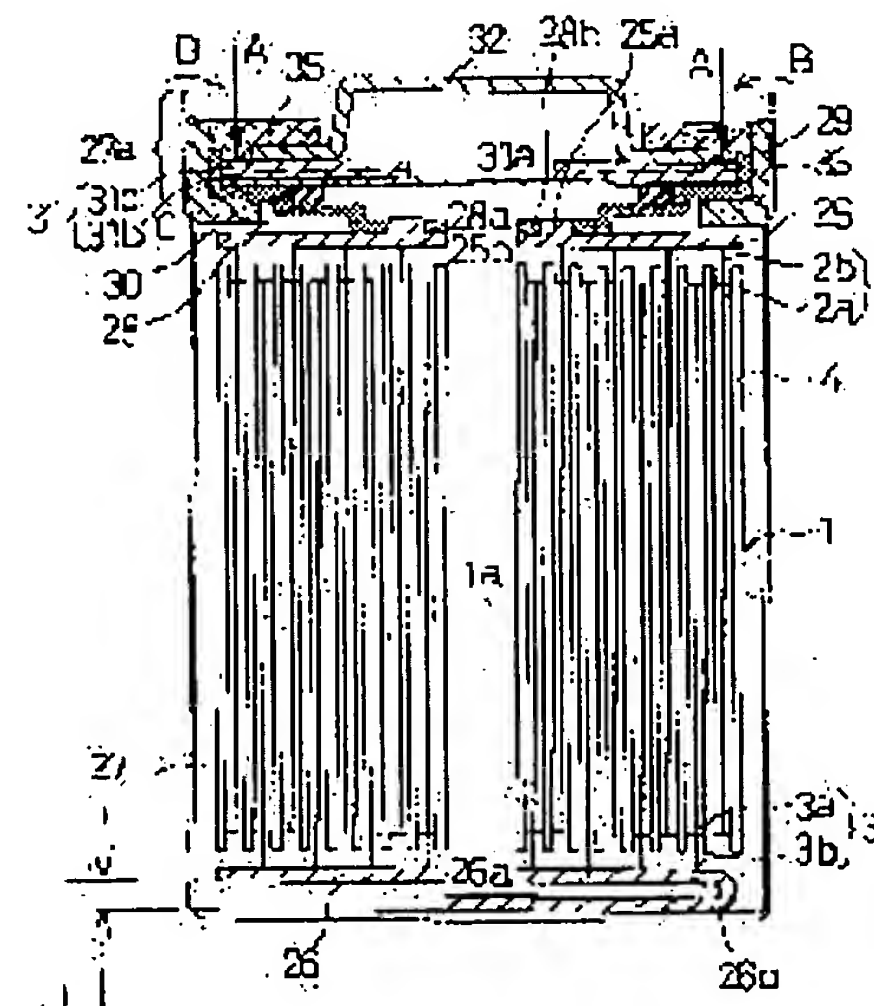
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(54) SECONDARY BATTERY AND ITS MANUFACTURING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a secondary battery capable of obtaining a high output by reducing an internal resistance, and its manufacturing method capable of easily assembling the battery without deforming component parts.

SOLUTION: The opening part of an armoring can 27 is sealed by a filter 28 forming a first sealing member integrally combined with a positive electrode collector plate 25 and disposed at the opening part of the armoring can 27 through a gasket 33 of an insulating member, and a spacer 31 forming a second sealing member combined with the filter 28 together with an explosion-proof valve body 30 of an explosion-proof means to exhaust internal gas in response to the rise of an internal pressure through an O-ring 29 of a sealing means, and an elastic bonding piece 26b provided on the negative electrode collector plate 26 is bonded to the inner bottom surface of the armoring can 27. Thereby, the output of the battery is increased by reducing its internal resistance, and the battery can be assembled without deforming component parts.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the rechargeable battery which held the group of electrode which comes to wind a forward negative-electrode plate through a separator in the sheathing can with the electrolytic solution, and its manufacture approach.

[0002]

[Description of the Prior Art] In recent years, the miniaturization of electronic equipment and lightweight-ization are progressing quickly, and the requests of small and lightweight-izing, and high-capacity-izing are mounting also to the cell as the power source. Moreover, from global environment problems, expectation grows also in an electric vehicle and a high increase in power is desired with small and lightweight-izing, and high capacity-ization to this cell. Development of a rechargeable lithium-ion battery is briskly performed to these requests.

[0003] Hereafter, the structure of the rechargeable battery of the conventional example is explained.

[0004] In drawing 5 which shows the configuration of the rechargeable lithium-ion battery of the conventional example, 1 is the group of electrode around which the positive-electrode plate 2 which positive-electrode charge collector 2b was made to plaster with positive-electrode ingredient 2a, and the negative-electrode plate 3 which made negative-electrode charge collector 3b plaster with negative-electrode ingredient 3a were wound by the curled form through the separator 4. 5 and 6 are the positive-electrode collecting electrode plates and negative-electrode collecting electrode plates which were joined by the both-ends side of a group of electrode 1. Positive-electrode tab 5a is welded to the positive-electrode collecting electrode plate 5.

[0005] This group of electrode 1 is held in the sheathing can 7 with the electrolytic solution, the resistance welding of the negative-electrode collecting electrode plate 6 is carried out to the inner base of the sheathing can 7, and the sheathing can 7 serves as a negative-electrode terminal of a cell. 8 is the filter which has hole 8a in the center section, and is uniting caulking section 8b of the periphery after insertion with the interior for O ring 9, the explosion-proof valve element 10, the spacer 11, and the cap 12 in total. Here, the explosion-proof valve element 10 is the thing of the shape of a thin film which consists of aluminum foil, and when cell internal pressure rises more than place constant pressure, it is constituted so that it may fracture from the hole 11a section of a spacer 11 and the gas inside a cell may be discharged outside. Positive-electrode tab 5a is welded to this filter 8, the current from a group of electrode 1 is made to go away filter 8, and is energized on cap 12 from section 8b, and cap 12 serves as a positive-electrode terminal of a cell.

[0006] 13 is the gasket infixed between the sheathing can 7 and the filter 8, and it also has the seal function by closing opening of the sheathing can 7 so that a filter 8 may be pinched while it insulates both.

[0007] Next, the manufacture approach of the rechargeable battery of the above configuration is explained. First, positive-electrode charge collector 2b of the positive-electrode plate 2 wound around the upper limit side is made to project, and it is made to make negative-electrode charge collector 3b of the wound negative-electrode plate 3 have projected to the lower limit side by shifting the positive-electrode plate 2, a separator 4, and the negative-electrode plate 3 little by little up and down, and winding them, respectively in manufacturing a group of electrode 1. Thus, the negative-electrode collecting electrode plate 6 is welded for the positive-electrode collecting electrode plate 5 which has joined positive-electrode tab 5a to the upper limit side of the constituted group of electrode 1 by welding beforehand to a lower limit side, respectively. Positive-electrode tab 5a currently welded to the positive-electrode collecting electrode plate 5 at this time is in a straight condition, as shown in drawing 6.

[0008] Next, as shown in drawing 6, a group of electrode 1 is held in the sheathing can 7, and the inner base of the negative-electrode collecting electrode plate 6 and the sheathing can 7 is welded by resistance. In that case, electrode 14a of welding is inserted from space 1a of the reel core part of a group of electrode 1, between

electrode 14b which is in contact with the outsole side of the sheathing can 7, it energizes a current and resistance welding is carried out. Then, plastic working is performed using a fixture etc. so that the sheathing can 7 which held the group of electrode 1 may allot slot 7a to a suitable distance lower part location from opening 7b.

[0009] Next, it is unified including O ring 9, the explosion-proof valve element 10, a spacer 11, and cap 12, and positive-electrode tab 5a is welded to the position of the filter 8 in the condition that fitting of the gasket 13 was carried out to the periphery. Moreover, specified quantity impregnation of the electrolytic solution is carried out from opening of the sheathing can 7 in this condition. Then, making positive-electrode tab 5a transform like drawing 5, fitting arrangement of a filter 8 and the gasket 13 is carried out in the upper part of slot 7a of the sheathing can 7, and a rechargeable battery is completed in total like drawing 5 in opening 7b of the sheathing can 7.

[0010]

[Problem(s) to be Solved by the Invention] However, as for positive-electrode tab 5a, predetermined die length is needed [from the physical relationship of a group of electrode 1, the sheathing can 7, and a filter 8] with the above-mentioned conventional configuration like drawing 6 in the case of welding of a filter 8 and positive-electrode tab 5a. And since it could not but become the deformation ***** activities of positive-electrode tab 5a when carrying out fitting arrangement of a filter 8 and the gasket 13 in the upper part of slot 7a of the sheathing can 7, it was difficult to specify the configuration of positive-electrode tab 5a after deformation proper.

[0011] Moreover, when it asks for the cell of high power, an effective means reduces the internal resistance of a cell. However, positive-electrode tab 5a of predetermined die length will bring about the increment in the internal resistance of a cell. Moreover, if the width of face and thickness of positive-electrode tab 5a are increased in order to reduce internal resistance, the reinforcement of positive-electrode tab 5a will go up, and deformation will become difficult. Furthermore, when the big force acts on the welding point of positive-electrode tab 5a and a filter 8 according to a deformation activity, welding may separate and it is connected also with the debasement of a cell.

[0012] Moreover, as mentioned above, since the current from a group of electrode 1 was made to go away filter 8 and was energized on the cap 12 from section 8b, it became connection by contact and had the trouble of causing the increment in the internal resistance of a cell as contact resistance.

[0013] Without solving the above-mentioned conventional trouble and transforming components, such as a positive-electrode tab, this invention can assemble a cell, is easy to manufacture and aims at offering the rechargeable battery with which internal resistance is reduced and high power is obtained, and its manufacture approach.

[0014]

[Means for Solving the Problem] The sheathing can with which the rechargeable battery of the 1st invention of this invention serves as one electrode terminal, and the group of electrode which comes to wind a forward negative-electrode plate through a separator, The electrolytic solution with which it sank into the interior of a group of electrode, and the collecting electrode plate of the positive electrode joined by the both-ends side of a group of electrode, and a negative electrode, The 1st obturation member which fixed in one to one of the collecting electrode plates of a positive electrode and a negative electrode, and was allotted to opening of a sheathing can through the insulating member, It consists of the 2nd obturation member which fixed through the seal means to the 1st obturation member with the explosion-proof means which discharges internal gas according to the rise of internal pressure. Through the piece of elastic junction of owner *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne., the collecting electrode plate of the direction which is not joined to the 1st obturation member opens a predetermined gap in the inner base of a sheathing can, and joins the piece of elastic junction to it. Since the assembly of a cell is possible, without transforming components, such as a positive-electrode tab, manufacture becomes easy, and internal resistance can be decreased, the output of a cell can be increased, and the rechargeable battery of the high power which reduced internal resistance is obtained.

[0015] The sheathing can with which the rechargeable battery of the 2nd invention serves as a negative-electrode terminal, and the group of electrode which comes to wind a forward negative-electrode plate through a separator, The electrolytic solution with which it sank into the interior of a group of electrode, and the collecting electrode plate of the positive electrode joined by the both-ends side of a group of electrode, and a negative electrode, The 1st obturation member which was connected to the positive-electrode collecting electrode plate, and was allotted to opening of a sheathing can through the insulating member, It consists of the 2nd obturation member which fixed through the seal means to the 1st obturation member with the explosion-proof means which discharges internal gas according to the rise of internal pressure. The 2nd obturation member is constituted from a clad plate with which the metal which has countered the 1st obturation member

consists of at least two or more kinds of dissimilar metals which are metals of the same kind. It can become welding of metals of the same kind by the 1st and 2nd obturation member, internal resistance can be decreased, and the output of a cell can be increased.

[0016] Moreover, in the above-mentioned rechargeable battery, a sheathing can has the path of opening larger than other parts, and before, if plastic deformation is carried out before attachment so that it may become the part of almost others, and a diameter of said after attachment, it can secure the insulation and seal by the insulating member with a cheap means.

[0017] The sheathing can with which the manufacture approach of the rechargeable battery the 3rd invention serves as one electrode terminal, The group of electrode which comes to wind a forward negative-electrode plate through a separator, and the electrolytic solution with which it sank into the interior of a group of electrode, The 1st obturation member which was connected to one of the collecting electrode plate of the positive electrode joined by the both-ends side of a group of electrode, and a negative electrode, and the collecting electrode plates of a positive electrode and a negative electrode, and was allotted to opening of a sheathing can through the insulating member, It is the manufacture approach of the rechargeable battery which consists of the 2nd obturation member which fixed through the seal means to the 1st obturation member with the explosion-proof means which discharges internal gas according to the rise of internal pressure. After connecting the 1st obturation member to one of collecting electrode plates after joining the collecting electrode plate of a positive electrode and a negative electrode to the both-ends side of a group of electrode Insert a group of electrode in a sheathing can, and the collecting electrode plate of another side is joined to the bottom surface part of a sheathing can. The 2nd obturation member is fixed for the electrolytic solution to the 1st obturation member through a seal means after specified quantity impregnation, a cell can be assembled, without transforming the components which connect an obturation member with a collecting electrode plate by **** activities, and manufacture becomes easy from the hole established in the 1st obturation member.

[0018] Moreover, if plastic deformation of the part for a major diameter is carried out to the path of the part of almost others after closing opening of a sheathing can after fixing the 2nd obturation member to the 1st obturation member using the sheathing can which has the path which the part in which an insulating member is inserted becomes from other parts size, an insulation and a seal will be certainly made with a cheap means.

[0019]

[Embodiment of the Invention] Hereafter, 1 operation gestalt which applied the rechargeable battery of this invention to the lithium ion battery is explained with reference to drawing 1 - drawing 4.

[0020] In drawing 1 which shows the configuration of the rechargeable battery of this operation gestalt, 1 is a group of electrode and is the same configuration as what was explained in the conventional example. if the positive-electrode plate 2 and the negative-electrode plate 3 are explained to a detail, positive-electrode charge collector 2b consists of aluminum foil, applies positive-electrode ingredient 2a which contains positive active material and a binder to the both sides, and the positive-electrode plate 2 constitutes it -- having -- **** -- as the positive active material -- LiCoO_2 , LiMn_2O_4 , and LiNiO_2 etc. -- it is used. Negative-electrode charge collector 3b consists of copper foil, negative-electrode ingredient 3a which contains a negative-electrode active material and a binder to the both sides is applied, the negative-electrode plate 3 is constituted, and carbonaceous ingredients, such as graphite, petroleum coke, and a carbon fiber, etc. are used as the negative-electrode active material.

[0021] 25 and 26 are the positive-electrode collecting electrode plates and negative-electrode collecting electrode plates which were joined by the both ends of a group of electrode 1. While heights 25a is formed in the perimeter top face of a core at the positive-electrode collecting electrode plate 25, hole 25b is formed in the center position. While hole 26a is formed in a center position at the negative-electrode collecting electrode plate 26, piece of elastic junction 26b which extended to the location where it is turned up by one side edge about 180 degrees, and a point counters hole 26a is prepared.

[0022] 27 is a sheathing can and the predetermined section of the opening 27a has the path which consists of other parts size. 28 is the aluminum as 1st obturation member, or a filter made from an aluminum containing alloy, and while hole 28a is formed in a mid gear, hole 28b which fits into heights 25a of the positive-electrode collecting electrode plate 25 is formed in the perimeter. The explosion-proof valve element which the O ring as a seal means and 30 become from the aluminum foil as an explosion-proof means in 29, and 31 are the spacers used as the 2nd obturation member. On the other hand, near member 31c is the same nickel as cap 32, below-mentioned iron, or those below-mentioned alloys, and member 31b by the side of the field where this spacer 31 has countered with the filter 28 consists of the same aluminum or the same aluminum containing alloy as a filter 28, and a clad plate which stuck them in cold pressure welding. Moreover, when cell internal pressure rises more than predetermined, the explosion-proof valve element 30 fractures from hole 31a formed in the core of a spacer 31, and discharges the gas inside a cell outside. 32 is the cap used as the positive-electrode terminal of a

cell. As the quality of the material of this cap 32, in using this cell as a group cell, it consists of nickel, iron, or those alloys so that more easily [welding] than welding a connection plate (not shown) etc. in many cases. The gasket with which 33 becomes an insulating member, and 35 are electric insulating plates.

[0023] Next, the manufacture approach of the rechargeable battery of the above configuration is explained. A group of electrode 1 is manufactured like explanation of the conventional example, and positive-electrode charge collector 2b of the positive-electrode plate 2 wound around the upper limit side is made to project, and it is made to make negative-electrode charge collector 3b of the wound negative-electrode plate 3 have projected to the lower limit side by shifting the positive-electrode plate 2, a separator 4, and the negative-electrode plate 3 little by little up and down, and winding them, respectively. And since positive-electrode charge collector 2b is aluminum foil, the negative-electrode collecting electrode plate 26 is welded for aluminum or the positive-electrode collecting electrode plate 25 made from an aluminum containing alloy to the upper limit side of a group of electrode 1 in a lower limit side, respectively. Next, where a filter 28 is inserted in a gasket 33, while piling up the filter 28 on the positive-electrode collecting electrode plate 25, heights 25a of the positive-electrode collecting electrode plate 25 is made to insert in the hole 28b, and from the upper part, laser welding is carried out and it fixes in one with the positive-electrode collecting electrode plate 25.

[0024] Next, as shown in drawing 2 , the group of electrode 1 which fixed the filter 28 in one is inserted into the sheathing can 27 with a gasket 33, and the inner base of the sheathing can 27 is joined to piece of elastic junction 26b of the negative-electrode collecting electrode plate 26 by resistance welding. In that case, as shown in drawing 3 , electrode 34a of welding penetrates hole 28a of the center section of the filter 28, hole 25b of the positive-electrode collecting electrode plate 25, space 1a of the reel core part of a group of electrode 1, and hole 26a of the negative-electrode collecting electrode plate 26, and is contacted by piece of elastic junction 26b. And it energizes between electrode 34b which is in contact with the outsole side of the sheathing can 27, and joins in resistance welding.

[0025] Next, specified quantity impregnation of the electrolytic solution is carried out, and it is made to sink into the group-of-electrode 1 interior from hole 28a of a filter 28. In addition, as this electrolytic solution, lithium salt, such as 6 phosphorus-fluoride acid lithium (LiPF_6), lithium perchlorate (LiClO_4), and lithium fluoride (LiBF_4), is used as a solute, non-aqueous solvents, such as ethylene carbonate (EC), propylene carbonate (PC), diethylene carbonate (DEC), and ethylene methyl carbonate (EMC), etc. are used as a solvent, and what dissolved the solute in this solvent is used.

[0026] Then, O ring 29 and the explosion-proof valve element 30 made from aluminum foil are arranged in the predetermined location of a filter 28. The resistance welding of the cap 32 which consists of nickel, iron, or those alloys is beforehand carried out to member 31c which consists of the nickel, the iron, or those alloys of a spacer 31, it is piled up on the explosion-proof valve element 30 of a filter 28, laser welding of a spacer 31 and the filter 28 is carried out in the location of A of drawing 1 , pressurizing with a fixture etc., and the filter 28 which is the 1st obturation member, and the spacer 31 which is the 2nd obturation member are fixed. Moreover, O ring 29 infixed among both performs a seal. Although laser is irradiated from the member 31c side of a spacer 31 at this time, the filter 28 which consists of the explosion-proof valve element 30, the aluminum, or the aluminum containing alloy which consists of member 31b which consists of aluminum or an aluminum containing alloy with that heat, and aluminum foil fuses, and welding is completed.

[0027] Next, after equipping with an electric insulating plate 35, or [like an arrow head B for opening of the sheathing can 27] is closed. At this time, since it has fitted in with a part for the major diameter of the sheathing can 27, a gasket 33 will be fixed by the ability receiving in the change section C of a path.

[0028] Since piece of elastic junction 26b is bent about 180 degrees in this condition and the negative-electrode collecting electrode plates 26 are formed successively, they are located in the condition that Gap H exists, between a group of electrode 1, the field currently welded, and the inner base of the sheathing can 27. With the elasticity of this gap H and piece of elastic junction 26b, even when the location of a gasket 33 and a filter 28, the width of face of a group of electrode 1, etc. vary, it becomes possible to absorb dispersion and an unnecessary load is not given to a group of electrode 1.

[0029] Next, plastic deformation of the major diameter of the sheathing can 27 is carried out to the path of the part of almost others by pressurizing in the direction of arrow-head D, and letting the rechargeable battery manufactured as mentioned above pass to the diameter reduction fixture 36, as shown in drawing 4 . At this time, you are made to compress a gasket 33 between the sheathing can 27 and a filter 28 by the plastic deformation of the sheathing can 27, and while performing an insulation of the sheathing can 27 and a filter 28, it will have a seal function.

[0030] The group of electrode 1 which comes to wind the sheathing can 27 used as a negative-electrode terminal, and the forward negative-electrode plates 2 and 3 through a separator 4 as mentioned above according to this operation gestalt, The electrolytic solution with which it sank into the group-of-electrode 1 interior, and

the positive-electrode collecting electrode plate 25 and the negative-electrode collecting electrode plate 26 joined by the both-ends side of a group of electrode 1, The filter 28 which is the 1st obturation member which fixed in one to the positive-electrode collecting electrode plate 25, and was allotted to opening of the sheathing can 27 through the gasket 33 which is an insulating member, It consists of a spacer 31 which is the 2nd obturation member which fixed through O ring 29 which is a seal means in the filter 28 with the explosion-proof valve element 30 which is the explosion-proof means which discharges internal gas according to the rise of internal pressure. Since the predetermined gap H was opened in the inner base of the sheathing can 27 and piece of elastic junction 26b of the negative-electrode collecting electrode plate 26 was joined to it, components, such as a positive-electrode tab for connecting a filter with a positive-electrode collecting electrode plate, can be abolished, and the output of a cell can be increased by reduction in internal resistance.

[0031] Moreover, since the spacer 31 is constituted from a clad plate with which the metal which has countered the filter 28 consists of at least two or more kinds of dissimilar metals which are metals of the same kind, welding of metals of the same kind can be attained, internal resistance can be decreased, and the output of a cell can be increased.

[0032] Moreover, a positive electrode and the negative-electrode collecting electrode plates 25 and 26 are joined to the both-ends side of a group of electrode 1. After welding a filter 28 to the positive-electrode collecting electrode plate 25, a group of electrode 1 is inserted in the sheathing can 27. By welding piece of elastic junction 26b of the negative-electrode collecting electrode plate 26 to the bottom surface part of the sheathing can 27, and taking the manufacture approach of fixing a spacer 31 for the electrolytic solution in a filter 28 after specified quantity impregnation from hole 28a prepared in the filter 28 A cell can be assembled without transforming component parts, such as a positive-electrode tab for connecting a filter with a positive-electrode collecting electrode plate, by **** activities, and if manufacture is easy and forces, improvement in quality can also be aimed at.

[0033] Moreover, the part in which the gasket 33 whose sheathing can 27 is an insulating member is inserted has the path which consists of other parts size, and after fixing a spacer 31 in a filter 28, after closing opening of the sheathing can 27, an insulation and a seal are certainly made with a cheap means by carrying out plastic deformation of the part for a major diameter to the path of the part of almost others.

[0034] In addition, although the explosion-proof valve element 30 which is the explosion-proof means which discharges internal gas according to the rise of internal pressure was used as one component part made from aluminum foil in the above explanation, it is good also as a clad plate created by carrying out cold pressure welding of the spacer 31 which is the 2nd obturation member also including this aluminum foil.

[0035] Moreover, although the sheathing can 27 was made into the negative-electrode side for the filter 28 in the above explanation at the positive-electrode side, a forward negative electrode is made reverse, in a filter 28, it is good also as a positive-electrode side, and the sheathing can 27 serves as [can / 27 / sheathing] aluminum or a product made from an aluminum containing alloy in that case at a negative-electrode side.

[0036]

[Effect of the Invention] According to the rechargeable battery of this invention, the collecting electrode plate of a positive electrode and a negative electrode is joined to the both-ends side of a group of electrode as mentioned above. The 1st obturation member is fixed in one to one of the collecting electrode plates of the positive electrode and a negative electrode. The 2nd obturation member is fixed through a seal means with the explosion-proof means which discharges internal gas according to the rise of internal pressure to this 1st obturation member while allotting this 1st obturation member to opening of a sheathing can through an insulating member. Since the collecting electrode plate of the direction which is not joined to the 1st obturation member opened the predetermined gap in the inner base of a sheathing can and has joined the piece of elastic junction to it through the piece of elastic junction of owner *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne. Since a positive-electrode tab etc. is not used while a cell can be assembled and manufacture becomes easy, without transforming components, such as a positive-electrode tab which connects an obturation member with a positive-electrode collecting electrode plate, internal resistance can be decreased, the output of a cell can be increased, and the rechargeable battery of the high power which reduced internal resistance is obtained.

[0037] Moreover, if the 2nd obturation member is constituted from a clad plate with which the metal which has countered the 1st obturation member consists of at least two or more kinds of dissimilar metals which are metals of the same kind, it can become welding of metals of the same kind by the 1st and 2nd obturation member, internal resistance can be decreased, and the output of a cell can be increased.

[0038] Moreover, in the above-mentioned rechargeable battery, a sheathing can has the path of opening larger than other parts, and before, if plastic deformation is carried out before attachment so that it may become the part of almost others, and a diameter of said after attachment, it can secure the insulation and seal by the insulating member with a cheap means.

[0039] Moreover, after connecting the 1st obturation member to one of collecting electrode plates after joining the collecting electrode plate of a positive electrode and a negative electrode to the both-ends side of a group of electrode according to the manufacture approach of the rechargeable battery of this invention From the hole which inserted the group of electrode in the sheathing can, joined the collecting electrode plate of another side to the bottom surface part of a sheathing can, and was established in the 1st obturation member, since the 2nd obturation member is fixed to the 1st obturation member through a seal means after specified quantity impregnation, the electrolytic solution A cell can be assembled without transforming the components which connect an obturation member with a collecting electrode plate by **** activities, and manufacture becomes easy.

[0040] Moreover, if plastic deformation of the part for a major diameter is carried out to the path of the part of almost others after closing opening of a sheathing can after fixing the 2nd obturation member to the 1st obturation member using the sheathing can which has the path which the part in which an insulating member is inserted becomes from other parts size, an insulation and a seal will be certainly made with a cheap means.

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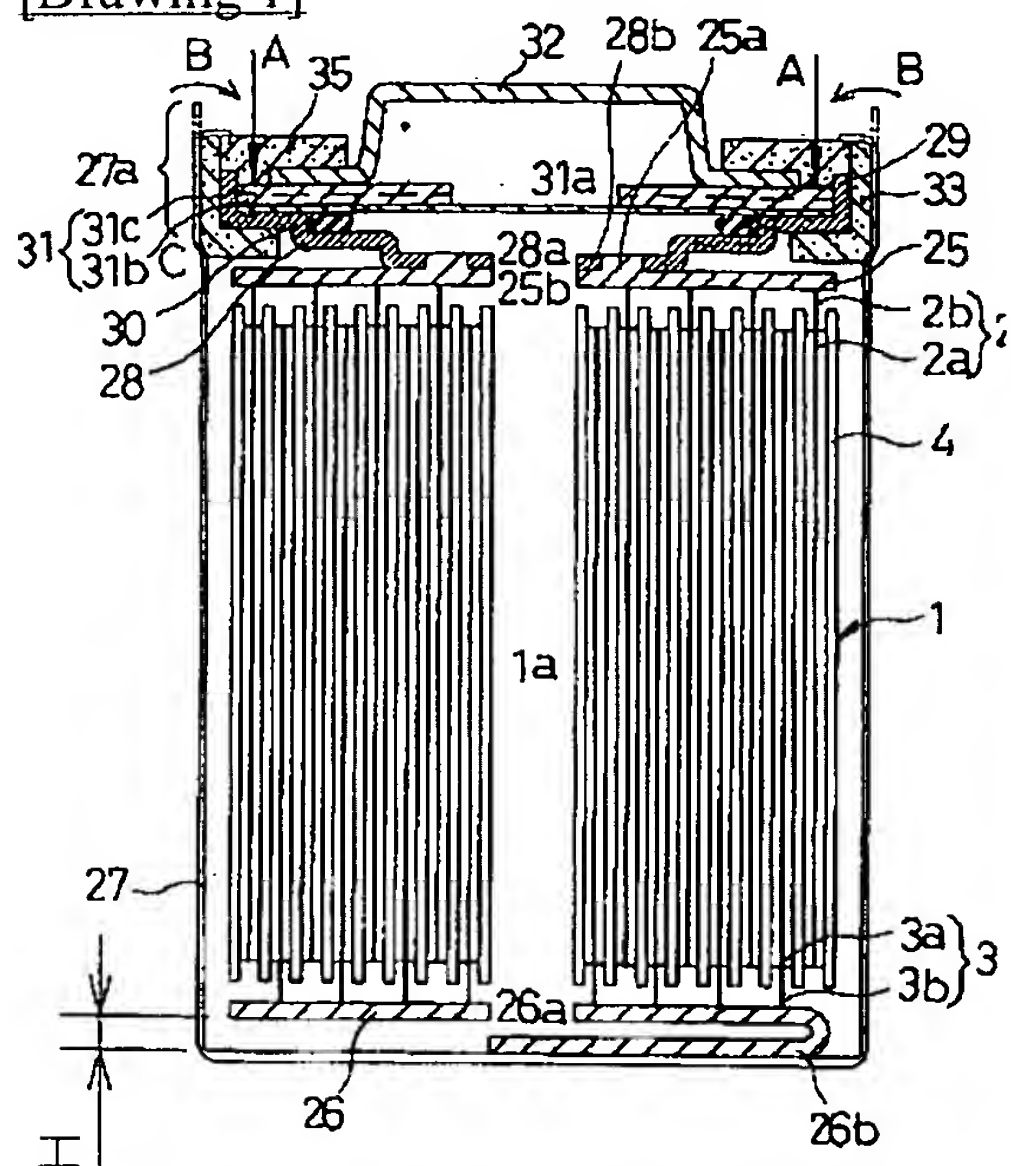
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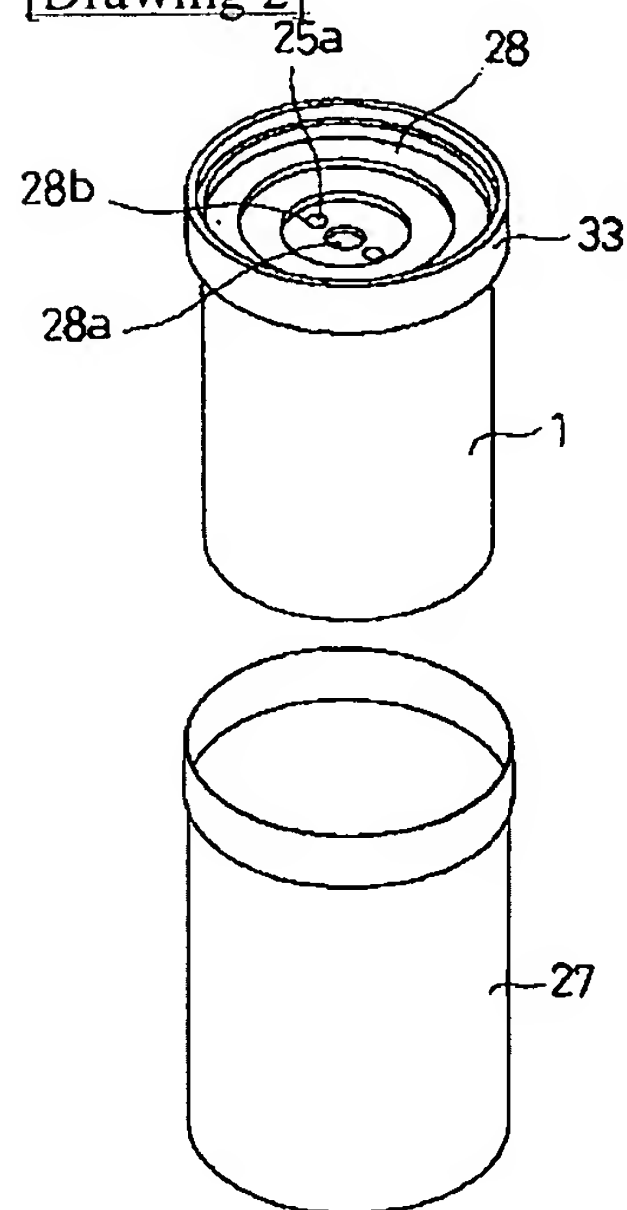
DRAWINGS

[Drawing 1]

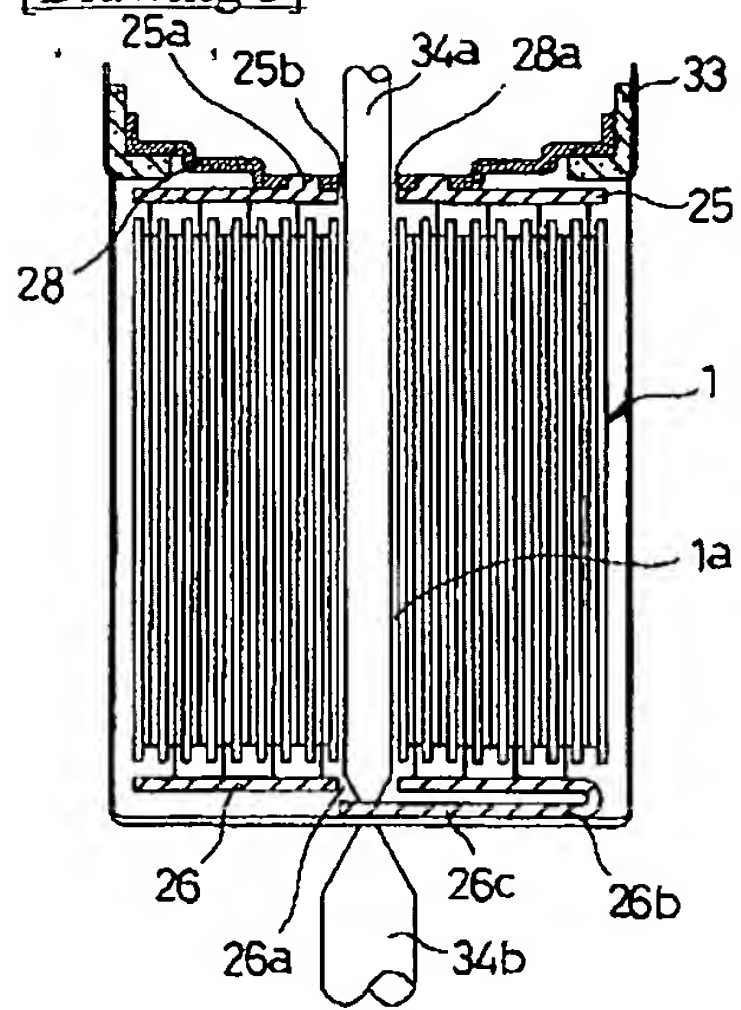


- | | |
|-------------|-------------------|
| 1…極板群 | 2 7…外装缶 |
| 2…正極板 | 2 8…フィルタ（第1の封口部材） |
| 3…負極板 | 2 9…Oリング（シール手段） |
| 4…セパレータ | 3 0…防爆弁体（防爆手段） |
| 2 5…正極集電板 | 3 1…スパーサ（第2の封口部材） |
| 2 6…負極集電板 | 3 3…ガスケット（絶縁部材） |
| 2 6 b…弾性接合片 | |

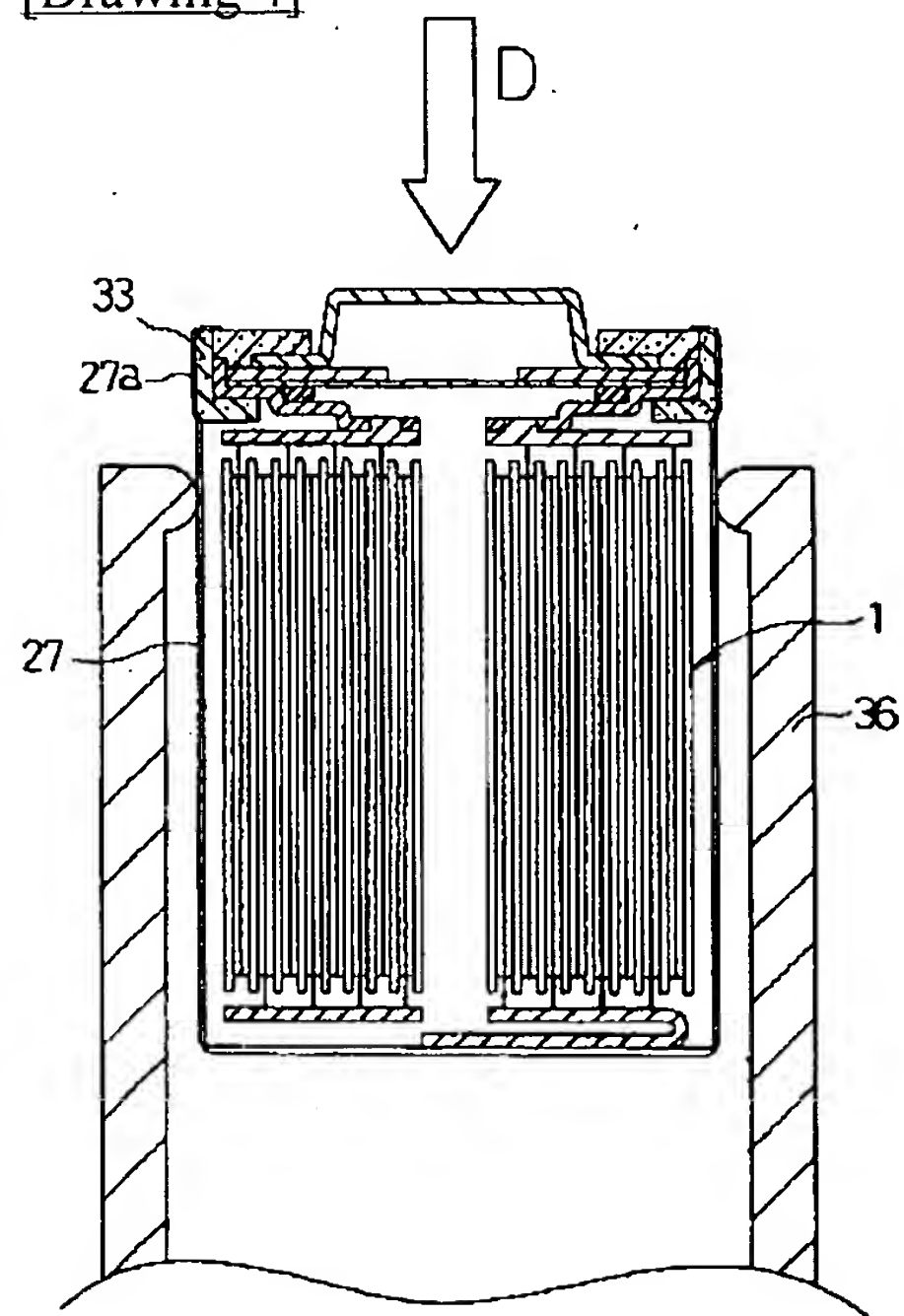
[Drawing 2]



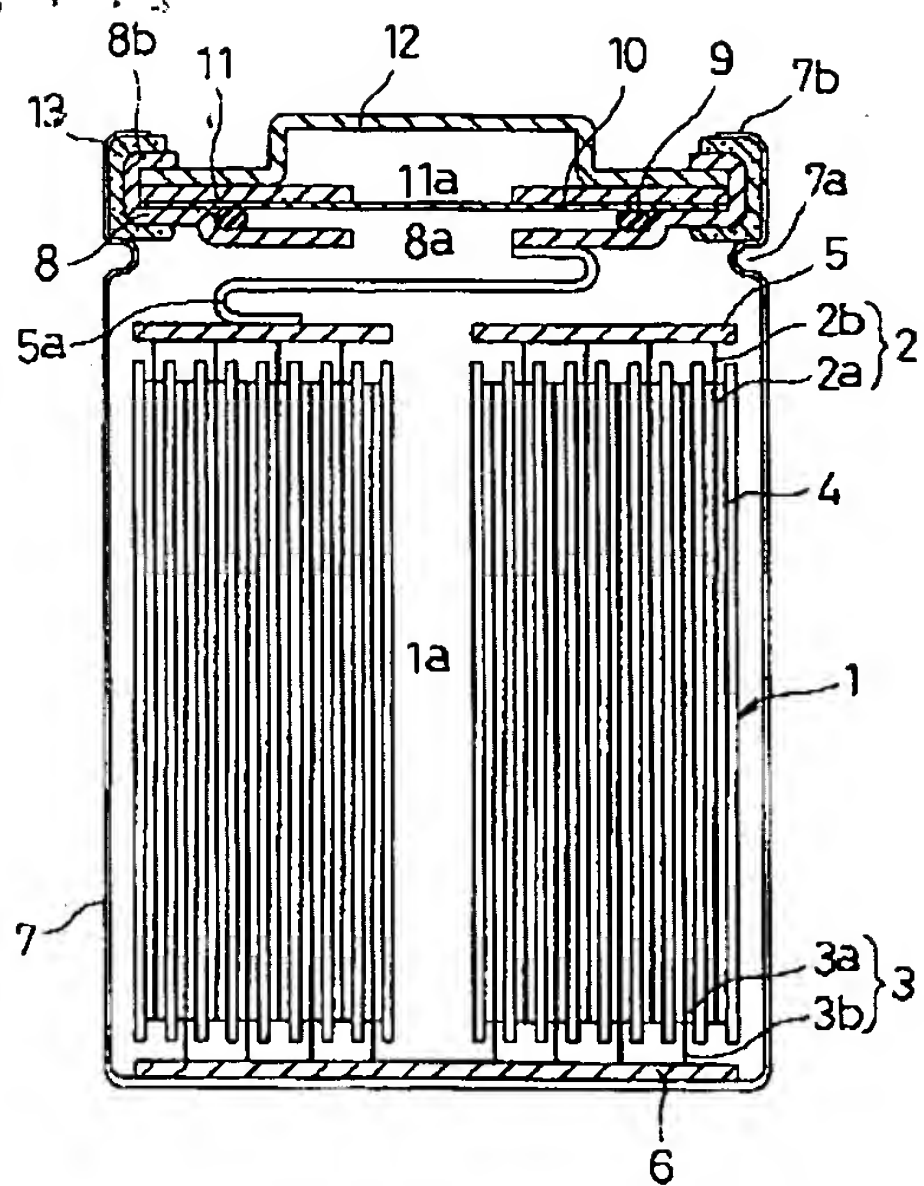
[Drawing 3]



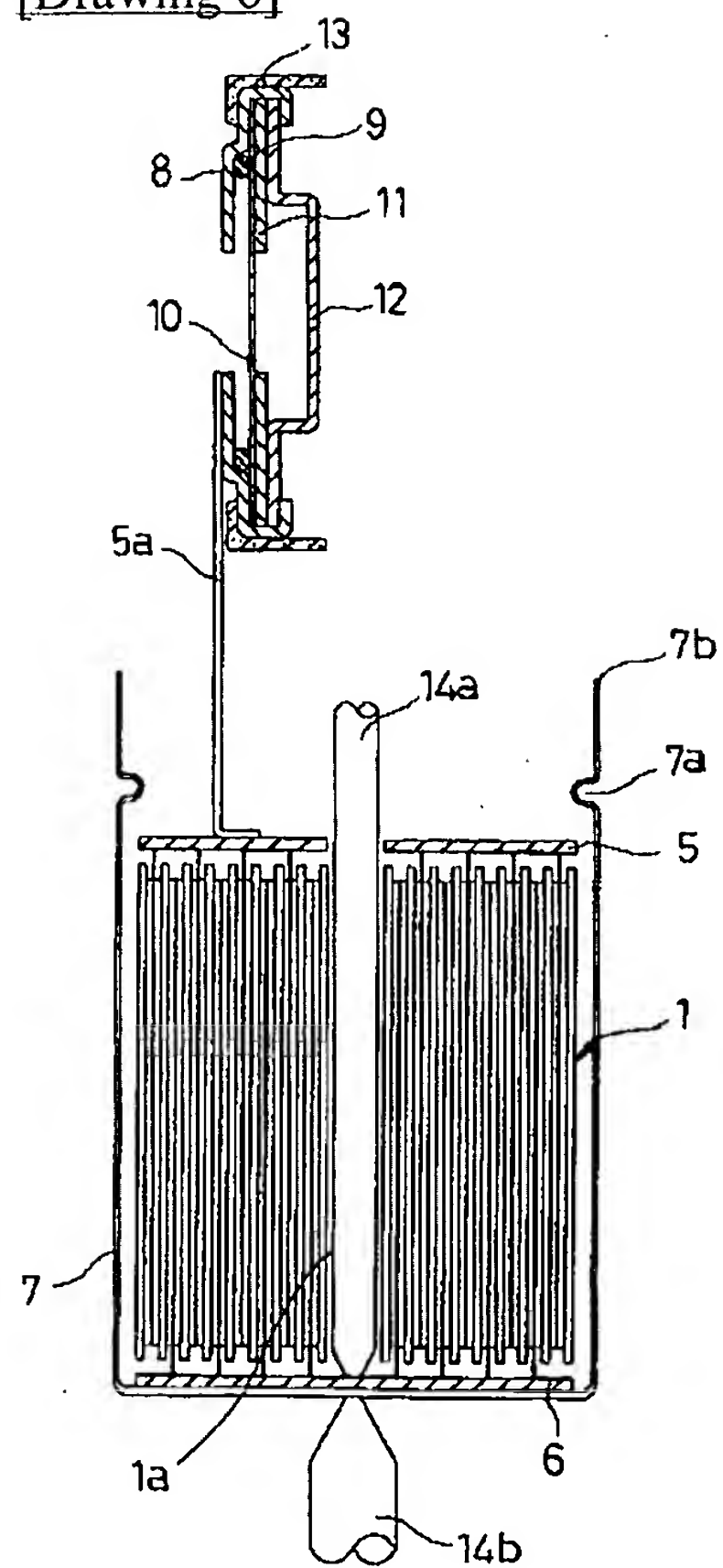
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]

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